Lifetime Measurements Superdeformed Bands in ^{192,193}Hg

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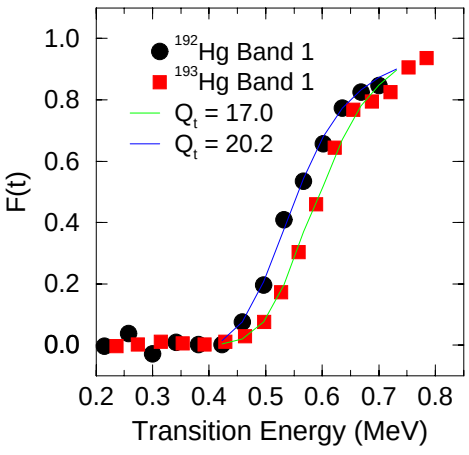
Much of our understanding of A$\sim$190 superdeformed (SD) bands stems from a knowledge of their transition energies. It is clear that precise measurements of other nuclear properties, such as level spins and deformations (or quadrupole moments, Q_t), are necessary in order to better understand these nuclei, and in particular the "identical band" phenomenon. Here, we report on a measurement of Q_t values of multiple SD bands in ^{193}Hg, and a comparison of Q_t values of SD bands in the neighboring odd-A and even-A nuclei, ^{193}Hg and ^{192}Hg [1]. The Q_t values determined in this work were obtained simultaneously in a single experiment, which reduces the systematic uncertainties due to stopping power calculations. The experiment was performed at the LBNL 88-Inch cyclotron using Gammasphere. The target consisted of a 1 mg/cm^2 ^{176}Yb foil evaporated onto a 6.8 mg/cm^2 ^{197}Au backing, which served to slow and stop the recoiling nuclei.

Lifetimes of the SD states were determined by a Doppler-shift attenuation method (DSAM) measurement. For each SD transition, a fraction-of-full-Doppler-shift ($F(\tau)= \bar{v}/v_0$) curve was determined (see figure). The experimental $F(\tau)$ values were then fitted with calculated $F(\tau)$ curves to obtain the average in-band quadrupole moment (Q_t), and the average quadrupole moment associated with the unknown side-feeding states (Q_s). Quadrupole moments of band 1 in ^{192}Hg and bands 1 and 4 in ^{193}Hg were also determined by a lineshape analysis.

The six ^{193}Hg SD bands are found to have similar $F(\tau)$ values, implying similar Q_t values and deformations. This means the active single-particle orbitals of ^{193}Hg do not have large shape-driving effects. The $F(\tau)$ values of the ^{192}Hg yrast SD band and the ^{193}Hg SD bands are not the same. If this difference was due to ^{192}Hg and ^{193}Hg having different quadrupole moments, then the identical bands, ^{192}Hg(1) and ^{193}Hg(2,3), would have different deformations. However, at this time it cannot be unambiguously stated that this discrepancy is due to differences in the Q_t values, but may reflect differences in the feeding time-profiles for the bands. The fact that a difference in the ^{192}Hg and ^{193}Hg Q_t values would have important consequences in the understanding of identical band properties means that, at the very least, this is a result that deserves further investigation.



References

[1] B.Busse et al., Phys. Rev. **C57** (1997).